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hands ; often, as it seems probable, without resting hand or arm on the table at all. Therefore there is no coincidence of the lines in this part of the composite, and the *region* of variation is wider than that of any other part of the signature.

All the signatures used in the accompanying plate (seven in number) are unquestionably genuine. With the exception of one, which is the property of Dr. Frazer, they were carefully chosen from a number of authenticated signatures in the possession of the Historical society of Pennsylvania.

No. 1 is on a letter dated Dec. 18, 1776, from near the Falls of Trenton, and addressed to Washington's brother Samuel.

No. 2 is on a letter dated Headquarters, Nov. 4, 1777, and is addressed to Lieut.-Col. Persifer Frazer, then a prisoner of war in Philadelphia.

No. 3 is on a letter dated Sept. 27, 1777, and is to William Henry of Lancaster.

No. 4 is the composite of all the rest.

No. 5 is on a letter dated Headquarters in Morristown, Feb. 22, 1777. The person to whom the letter was addressed is not stated.

No. 6, dated Sept. 26, 1793, is affixed to the commission of David Lenox.

No. 7, of the same date, is affixed to David Lenox's appointment as agent for the relief and protection of American seamen.

No. 8, dated May 24, 1799, closes a letter to Thomson Mason.

THE PSYCHOLOGY OF FEAR.

IF a true psychology is physiological, and if the physiological furniture of the world is largely the result of a vast series of experiments of which only the most successful ones have survived, it ought to be possible to find an important useful significance in the thought-habits, the instincts, the will-mechanisms, the emotions of animals, and more especially of man. It was this conviction that set Darwin to work on his 'Expression of the emotions in man and animals.' Among these emotions there is one, very wide-spread in the animal kingdom, as Dr. Romanes has shown ('Mental evolution in animals'), very important to the welfare of the animal, and typical of the suggestive conceptions resulting from the positing of a comparative and a physiological point of view, — the emotion of fear.

M. Charles Richet (*Revue de deux mondes*, July, 1886, pp. 73-118) considers it an apt time for presenting the subject in a popular manner ; and it may be equally worth while to give a short account of the scientific conception of fear, following in the main the article of M. Richet.

Emotions may be considered under two heads, according as they attract or repel the object by

which they are called up. The three chief emotions of the latter class are pain, disgust, and fear. Each of these emotions has a physical and a psychical aspect. We use the word 'pain' to mean the sensation resulting from a cut finger, and the emotion caused by the death of a friend. We can be disgusted by a nauseous concoction, and also morally disgusted at the mean conduct of a supposed friend. There is the paralyzing effect caused by the sudden appearance of a lion, and the dread of a coming examination. As in the other emotions connected with a definite disturbance of the nervous system, there appear in the animal scale and in human development all shades, from the simplest physical reflex to the most elaborated, consciously willed action. But the emotion itself — the fear — can be readily detected in all these varying modes of expression.

Repelling emotions are protective in their function. Pain gives us tidings of the condition of the organism, and thus demands the needed remedy, and averts injury. Disgust warns us of noxious substances. The object of fear is to advertise and escape danger to life. It would not do to leave the danger to be avoided by a reasoned action : there would be no time to form syllogisms. Nature puts the emotion first, and the reasoning afterwards. The chickens would soon disappear if they had not an instinctive fear of the fox. There is, then, a simple form of the emotion which expresses itself by an unreasoned, involuntary reflex action. These effects are well shown by the typical picture of terror, — the pale features, the limbs fixed powerless to move, trembling, chattering of teeth, altered heart-beat, gasping breath, cold perspiration, etc. These paralyzing effects of fear may reach a dangerous intensity, and produce death by arresting the activity of the heart. The story told by Dr. Lauder Brunton, of an instructor who had made himself obnoxious to the college students, and, after being blindfolded, was subjected by them to a process imitating death by decapitation, and found to be really frightened to death, is a case in point. It is said that condemned criminals are often nearly dead with fright before the instrument of death is applied. These physical effects of fear are best seen in the lower animals. The fear most commonly felt by us shows itself in what may be called a psychic reflex. In this case the sense stimulus is interpreted, and then the reflex expression of fear follows. If during a performance the rope of a trapeze breaks, the sensations by which that fact is made known are at once interpreted as a threatening danger, and by the force of sympathy fear will possess the spectators as well as the performer. Of course, this is not a natural stimulus.

It has already been noticed that the effect of fear may be of two kinds, — either exciting or paralyzing. The process by which this paralyzing is effected is inhibition. The spinal cord ministers to the reflex acts of the organism; the brain, to the voluntary and automatic. A stimulation of the higher centre may arrest the function of the lower. This probably is to some extent the normal condition, for the reflexes of a frog are more intense if the brain is removed. The will can delay or inhibit reflexes. We can keep back a cough or a cold. Over other reflexes the will has less control. Few can refrain from winking when a body is moved towards the eyes (Pliny records that gladiators were tested in this way). This psychic reflex is characterized by the fact that its intensity depends little on the intensity of the stimulus (as pain, for instance, does), but almost exclusively on the individuality of the subject. The person with a timid temperament is more readily and intensely frightened. Women, children, nervous persons, are disposed to fear. So, too, animals whose only defence is a rapid flight (hares, rats) are naturally timid, while aggressive beasts of prey are brave. Even the momentary condition, whether before or after dinner, will vary the intensity of fear. There are two psychic agencies which, *par excellence*, increase fear: they are imagination and attention. The man of vivid imagination who walks along a dark road will have many more frights than his prosaic companion. The fixation of the attention which expectation causes increases the fear. The ghost expected just at midnight is more terrible than an unexpected visitor. The emotion of fear depends, thus, on individual organization, and is not under the control of the will. What the will can do is to restrain the expression of the emotion. Courage is power of inhibition. The soldier cannot help being frightened, but he can help running away. The martyr is a hero, because he can inhibit that strongest of instincts, self-preservation.

To return to the teleological point of view, it may be asked to what extent the natural reflexes are useful. What are the best ways of escaping danger? One way is evidently by fleeing. To this corresponds the exciting effects of fear, which furnish the best conditions for speed and activity. Another way is to avoid observation by restraining movement. This is accomplished by the paralyzing effect of fear. The action is seen in its highest development in the death-feigning instincts of certain insects. The explanation of trembling is rather difficult: it certainly seems to be a hurtful action. M. Richet suggests that it is the result of an attempt to arrest motion, but of an attempt not entirely successful. The cry of

fear is perhaps an attempt to startle, and thus give a chance for escape.

Lastly, what are the excitants of fear? One group centres about the fear of death, of pain, and of disfavor. The first is the strongest; the second is active in small affairs; the last is of a more distinctively psychic nature. It is shown in stage-fright, where it may be accompanied by all the physical characteristics above described. Here, too, belong the peculiar sensations of vertigo to which some persons are subject to a pathological extent. It is impossible for them to cross a plank that bridges over a height. Even the bravest are subject to this feeling. That it is mental in its nature is shown, for example, by the fact, that, if a railing be set on the plank, even if too slight to be of any use in case of accident, the feeling may largely subside. It acts as a moral support. Another class of fears is inspired by the unfamiliar, by darkness, and by solitude. What is unfamiliar may be noxious. Caution is a useful trait. The savage and the child typically show this dread of something strange. The fear of ghosts also comes in this category. Darkness doubles fear: it makes things unfamiliar by preventing the use of that sense by which chiefly we recognize objects. Nobody feels perfectly at home in a strange dark room. Animals are more subject to fear at night. Man is naturally a social animal. Solitude is abnormal: it makes protection impossible. This feeling may become pathological: it has received the name of 'agoraphobia,' or the dread of open places.

A word on the power of habit over fear. M. Richet relates how he had occasion to pass frequently through a forest at night. He entered it boldly; but after a few steps the feeling came on, and he felt highly relieved when he saw the clear sky again. Each night he was able to keep up his bold step for a longer and longer distance, until finally the fear was almost overcome. Habit is the only method of removing fear. Workmen in powder-mills know they are in constant danger, but have no fear. To educate a child to be brave, the habit of not fearing darkness and solitude, and so on, must be gradually taught. J. J.

GEOLOGY OF LONG ISLAND.

THE current volume of Annals of the New York academy of sciences contains an article on the 'Geology of Long Island,' by F. J. H. Merrill, giving much definite and historical information. Mather first described it in the State natural history survey, 1842; Upham studied its moraines, in connection with those of Cape Cod, in 1879; Lewis has at various times examined its fossil-